REMARKS

This is a Supplemental Amendment to the amendment filed on August 8, 2002. The additional or supplemental remarks are italicized to assist the Examiner in identifying the remarks that are supplemental to the amendment filed on August 8, 2002.

Claims *1-2 and 4-15* are now present in this application. Claims 1 and 8 are independent claims. Claim 3 has been cancelled and claims 1, 2, 4, 5, 8 *and 9-11* have been amended by this Reply. Claims 14 and 15 are new.

SPECIFICATION OBJECTIONS

The Examiner objected to the Specification due to an informality. In particular, the Examiner noted that the units are needed for "4 x 10^{12}" on page 8, line 22 and page 9, line 14.

As per the Examiner's objection the Specification is amended herein to recite the units of "ions/cm^2" with reference to "4x10^{12}" as used on page 8, line 22 and page 9, line 14. The units for the doses are well known to those of ordinary skill in the relevant semiconductor art. Therefore, no new matter is believed to be added by the Specification amendments.

CLAIM OBJECTIONS

Claims 2, 5 and 9 have been objected to by the Examiner due to informalities. In particular, the Examiner noted that unit of doses are needed for

the expressions "$8x10^{12}$" and "$4x10^{12}$." Additionally, the Examiner contends that there is a lack of support in the specification for use of "$8x10^{12}$" in claim 2.

As per the Examiner's objection, claim 9 is amended herein to include the units of "ions/cm^2," which as discussed above are the appropriate units. Even though claim 10 and 11 were not clearly objected to by the Examiner, these claims are also amended herein to include the units of "ions/cm^2."

Applicants disagree with the Examiner's objection to claim 2 due to the lack of support for "$8x10^{12}$." As described in the Specification (page 8, line 20 – page 9, line 3) and in claim 3, a first halo implant process is performed twice at a dose of 4×10^{12} ions/cm^2. Therefore, the total dose is $8x10^{12}$ ions/cm^2.

However, due to the inclusion of the first and second halo implant processes in claim 1 as amended, claim 2 is amended to recite that the first and second halo implant processes are performed with a dose of $4.0x10^{12}$ ions/cm^2 and the Examiner's objection is moot.

Applicants note that the amendments to claims 2 and 9-11 are not in response to a statutory requirement or prior art. Additionally, the amendments are not believed to be narrowing amendments.

REJECTIONS UNDER 35 U.S.C. § 102

Claims 1-13 have been rejected under 35 U.S.C. § 102 (a) as being unpatentable over Cheek et al. (U.S. Pat. No. 6,372,587 B1). Applicants

respectfully traverse this rejection.

Cheek et al. disclose a semiconductor processing technique for using a halo implant process to form an asymmetrical halo implant. As shown in Figs. 5 and 6, an asymmetrical halo implant 535 is formed adjacent the left side of gate structure 300. Additionally, a halo implant is also formed adjacent the mask 510. As discussed in col. 6, lines 10-18, the halo implants are formed by a halo dopant of an angle between 25-65 degrees with respect to substrate surface. A second halo dopant process may also be performed after rotating the substrate by 180 degrees. However, the mask 510 prevents the formation of a symmetrical halo implant around the gate structure 300. See col. 6, lines 44-45. Cheek et al. further disclose the option of a third implant 1200 shown in Fig. 12 as being perpindicular to the substrate and able to be performed before or after the halo dopant processes of Figs. 5 and 6.

Cheek et al. discuss that symmetrical halo implants could be formed using the implant processes of Figs. 5 and 6 when the mask 510 is not present. However, Cheek et al, do not disclose that the third implant would still be performed if symmetrical implants were formed using the dopant processes of Figs. 5 and 6.

Since Cheek et al. is directed towards processing techniques for forming asymmetrical halo implants around gate structures, Cheek et al. do not disclose, "forming symmetrical first and second implants by performing a first

halo implant process and a second halo implant process on the first region . . . and performing a third halo implant process on the first region of the semiconductor substrate by using a tilt angle of about 0°, " as recited by claim 1 as amended and similarly claim 8 as amended.

Accordingly, claims 1 and 8 are allowable over the prior art. Regarding dependent claims 2, 4-7 and 9-13, these claims are allowable for at least the same reasons as their corresponding independent claims.

New claims

Newly added claims 14 and 15 are supported in the Specification on at least page 10, lines 5-10. Further, claims 14 and 15 are allowable at least because of the reasons discussed with respect to claims 1 and 8, and further, because Cheek et al. do not disclose, "the first and second halo implants are homogenously doped," as recited in claims 14 and 15.

CONCLUSION

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider all presently outstanding rejections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone Jayne E. Saydah, Registration No.48,796, at (703) 205-8000, in the Washington, D.C. area. Prompt and favorable consideration of this Amendment is respectfully requested.

Attached hereto is a marked-up version of the changes made to the application by this Amendment.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachment: Version with Markings to Show Changes Made

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE TITLE

The title has been replaced as follows:

--METHOD OF FORMING A JUNCTION IN SEMICONDUCTOR DEVICE USING HALO IMPLANT PROCESSING--

IN THE SPECIFICATION

The paragraph beginning on page 8, line 13, has been rewritten as follows:

--As illustrated in Figures 3 and 4, in order to perform the ion implantation below gate patterns 13, a first halo implant process 25 is performed at a tilt angle C of approximately 45° at one side of the NMOS region 21 in parallel to the photoresist film pattern 15. The tilt angle C represents the degree of variation of the ion implantation from a line-D drawn perpendicular to the substrate. Here, the first halo implant process 25 is performed with an energy of 20KeV and a dose of 4.0×10^{12} ions/cm^2.--

The paragraph beginning on page 9, line 9, has been rewritten as follows:

--As shown in Figures 3 and 6, a third halo implant process 27 is vertically performed on the semiconductor substrate 11 at a tilt angle of approximately 0°. Here, the third halo implant process 27 is performed with an energy of 16KeV and a dose of 4×10^{12} ions/cm^2.--

IN THE CLAIMS

The claims have been amended as follows:

Claim 1. (Amended)

1. A method for forming a junction in a semiconductor device with symmetrical halo implants, comprising the steps of:

forming a photoresist film pattern on a semiconductor substrate excluding a first region;

forming symmetrical first and second implants by performing a first halo implant process and a second halo implant process on the first region of the semiconductor substrate by using a tilt angle of about 45° and twist angles of 0° and 180° corresponding to the first halo implant and second halo implant, respectively; and

performing a [second] third halo implant process on the first region of the semiconductor substrate by using a tilt angle of about 0°.

Claim 2. (Amended)

The method according to claim 1, wherein both the first halo implant process and second halo implant process are performed [is performed] with an energy of 20KeV and a dose of [8]4.0x10^{12} ions/cm^2.

Claim 4. (Amended)

The method according to claim 1, wherein the [second] third halo

implant process is performed only once at a tilt angle of about 0°.

Claim 5. (Amended)

The method according to claim 1, wherein the [second] third halo implant process is performed with an energy of 16KeV and a dose of 4×10^{12}.

Claim 8. (Amended)

A method for forming a junction with symmetrical halo implants in a semiconductor device, comprising the steps of:

providing a semiconductor substrate divided into a first conductive type MOS region and a second conductive type MOS region;

forming a photoresist film pattern on the second conductive type MOS region;

forming symmetrical first and second halo implants by performing first and second halo implant processes on the first conductive type MOS region at about a 45° tilt angle and at twist angles of about 0° and 180°, respectively; and

performing a third halo implant process on the first conductive type MOS region, by using a tilt angle of about 0°.

Claim 9. (Amended)

The method according to claim 8, wherein the first halo implant

process is performed with an energy of 20KeV and and a dose of $4.0x10^{12}$ ions/cm^2.

Claim 10. (Amended)

The method according to claim 8, wherein the second halo implant process is performed with an energy of 20KeV and a dose of $4.0x10^{12}$ ions/cm^2.

Claim 11. (Amended)

The method according to claim 8, wherein the third halo implant process is performed with an energy of 16KeV and a dose of $4x10^{12}$ ions/cm^2.

Claims 14 and 15 were added.

Claim 3 has been canceled.